

Medication Tracers: A Systems Approach to Medication Safety

Erin C. Hendrick, PharmD, MS,* Kathryn R. Montanya, PharmD, MS, FISMP,† and Niesha Griffith, MS‡

Abstract—The Ohio State University Health System Department of Pharmacy Performance Improvement Committee has designed a tool, based on the concept of The Joint Commission on Accreditation of Healthcare Organization’s patient tracer methodology, for continuous review of the medication-use process and to assess compliance with Medication Management Standards. Implementing this proactive strategy will improve the ability of institutions to continuously review the medication-use system in various practice areas and identify deviations in policy and practice. Key elements for successful implementation of the medication tracer tool are discussed.

Keywords—JCAHO; tracer methodology; medication use system; medication safety

Hosp Pharm — 2007;42:916–920

In January 2004, The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) implemented a survey process entitled “Shared Visions-New Pathways.”¹ One of the goals of the process is to evaluate the provision of safe and high-quality patient care rather than relying on what is described in written policies and procedures. Among the changes, the survey includes the use of the patient tracer methodology to examine critical processes, such as medication management, that impact patient safety.

The Ohio State University Health System (OSUHS) is a 1,120-bed tertiary care health system located in Columbus, Ohio.

The OSUHS Department of Pharmacy Performance Improvement Committee developed a tool, based on the concept of the patient tracer methodology, to be used for continuous evaluation of the entire medication-use process and for assessment of compliance with JCAHO Medication Management Standards (MM). This tool can be easily adapted by other health care systems for continuous evaluation of their own medication-use system, for identification of deviations in policy and procedure, and for targeting educational efforts at those areas in need of improvement.

The tool was designed to encompass all aspects of the med-

ication-use process: selection and procurement, storage, ordering and transcribing, preparing and dispensing, administering, and monitoring. The tool also incorporates many institution-specific factors that influence the quality and safety of the medication-use process.

BACKGROUND

Preventable adverse events are a leading cause of death in the United States. Medication errors are one of the leading causes of injury to hospital patients, and chart reviews reveal that over half of all hospital medication errors occur at the interfaces of care.² It is thought that over 1 million serious medication errors occur in US hospitals annually.³ The Adverse Drug Event (ADE) Prevention Study Group found that the overall ADE rate was 6.5 per 100 admissions; of these ADEs, 28% were judged preventable.⁴ ADEs have been associated with longer hospital stays, higher costs, and higher risk of death.⁵ Efforts to strengthen the integrity of the medication-use system may prevent many of these errors.⁶

Since the 1999 Institute of Medicine (IOM) report established a national goal of a 50% reduction in medical errors, government and non-government entities have offered incentives that encourage hospitals to establish safety initiatives aimed at reducing all types of medical errors.^{2,7-8} A subsequent IOM report, “Priority Areas for

*Clinical Consultant, Business Consulting, McKesson Medication Management, Denver, CO; †Regional Medication Safety Manager, Novant Health – Triad Region, Winston-Salem, NC; ‡Associate Director of Pharmacy, Ohio State University Medical Center, Department of Pharmacy, Columbus, OH.

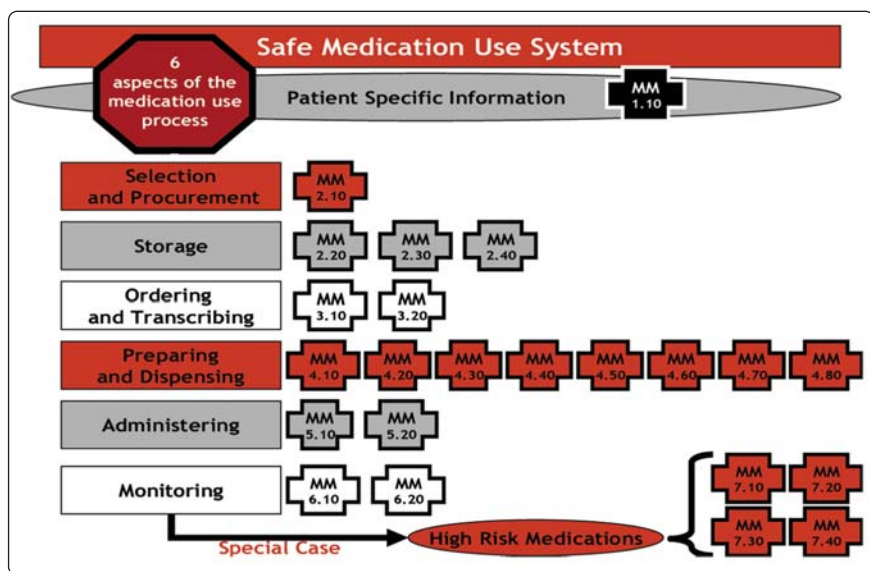


Figure 1. The Joint Commission on Accreditation of Healthcare Organization's Medication Management Standards (MM) align closely with the medication use process.

National Action: Transforming Health Care Quality," set medication management as a national priority and singled out pharmacists as playing a critical role.⁹

SYSTEMS APPROACH TO MEDICATION SAFETY

A key tenet of process improvement is that every system is perfectly designed to achieve the results it gets. The medication-use system was defined by JCAHO in 1989 as the "safe, effective, appropriate and efficient use of medications." However, deviations in practice can lead to medication-use system breakdowns and the emergence of errors. The concept of systems failures as the underlying causes of errors has not been widely accepted in the practice of medicine.¹⁰ Traditional efforts have focused on individuals and episodes, using training, exhortation, rules, and sanctions to improve performance.¹⁰ Regarding errors as primarily the result of sys-

tems failures is an idea whose time has come. Analysis and correction of underlying systems faults is more likely to result in enduring changes and significant error reduction.¹⁰

The basic premise in the systems approach is that humans are fallible and errors are to be expected.¹¹ Errors are seen as consequences rather than causes, having their origins in "upstream" systemic factors. By proactively ensuring the integrity of the system, it may be possible to erase the "upstream" systemic factors that are often found as fault. The idea of medication tracers is based on the premise that proactively maintaining and monitoring the integrity of the medication-use system will help ensure medication safety. The use of medication tracers, in addition to use of retroactive root-cause analyses, extensive failure mode, and effects analyses within a health care system, may reduce the risk of medication errors.

THE OSUHS MEDICATION TRACER TOOL

A medication tracer is an application of a methodology similar to that used by JCAHO when conducting "patient tracers." The medication tracer follows the medication through all aspects of the medication-use system, with focus on selection and procurement, storage, prescribing, ordering, transcribing, preparation, dispensing, administering, and monitoring the effects of medications. JCAHO MM align closely with the aspects of the medication-use system (see Figure 1), providing the core infrastructure of the tracer tool.

The elements of performance listed under each MM represent the key processes across all medication delivery systems that may benefit most from continuous evaluation and standardization. The tracer tool questions were developed to address each element of performance associated with MM 1.10 through 7.40. As envisioned by the OSUHS Department of Pharmacy Process Improvement Committee, the medication-use system tracer tool encourages ongoing evaluation of the medication-use system and can serve to identify deviations in policy and practice.

Though the tool may be used as an initial audit of the state of the medication-use process in an institution, the value of the tool becomes apparent when used in a continuous process improvement (CPI) effort. Many health care organizations have used the Langley, Nolan and Nolan Model for Improvement¹² successfully to reduce harm from medications. Medication tracers, acting to identify risk points and evaluate changes to the system, act as a process measure in this system. Continuous evaluation of the med-

ication-use system with such a tool provides a quantitative foundation for the following questions: “What are we trying to accomplish?”; “How will we know that a change is an improvement?”; “What changes can we make that will result in an improvement?” Using the key elements of the model, especially testing changes on a small scale with Plan-Do-Study-Act (PDSA) cycles, has consistently helped organizations reduce harm from medications.

A sample of the OSUHS Medication Tracer Tool is shown in Appendix A.

IMPLEMENTATION STRATEGY

To fully implement the medication tracer methodology and successfully add a balanced safety focus to CPI projects, leadership must be invested in the success of a safety-focused medication-use system. In addition to an extensive knowledge of the institution’s medication-use system, pharmacists involved in designing a medication tracer tool will need to understand the elements of performance associated with the JCAHO Medication Management Standards.

In designing and personalizing the tracer tool, the development team must determine the questions to ask, processes to observe, and information to obtain—both in the pharmacy areas and in the patient care areas. At OSUHS, the development team consisted of the pharmacy staff and, as such, the tool approached the medication-use process from the pharmacist’s point of view. A key point overlooked in this development process was the opportunity to collaborate with an interdisciplinary team. As we piloted the tool, we realized that many of the questions we asked on the nursing units were not worded for a “nursing perspective.”

The known risk points of a medication-use system and areas of concern identified through previous system evaluations or event reporting systems should also be incorporated into the tracer tool. MM.1.10 Element of Performance 2 states that “patient-specific information, including allergies and sensitivities, must be readily available and accessible to those involved in the medication management system.” Electronic and paper methods available for documentation of patient specific information are often a weakness identified in health care organizations. Knowing this, pertinent questions to ask would include: “Do the patient’s allergies and sensitivities listed in the computer order entry system match those listed in the paper medical record?”; “Do they match those listed in the pharmacy information system?”; “Does the anesthesia record match the pharmacy record?”

The utility and practicality of the tool must be considered. As medication management encompasses all aspects of the medication-use process, within the Department of Pharmacy and in the patient care areas, the tracer tool was divided into two separate components. One checklist (specifically aimed at addressing MM1.10 through 4.80) was completed in the pharmacy dispensing area (either in the central pharmacy area or in a pharmacy satellite, where the medication was dispensed) and one checklist (focused on MM 5.10 through 7.40) was completed in the patient care area, where the medication was administered.

Upon completion of the tracer tool design, the tracer team needed to determine how often the tracers would be completed, how many would be completed each month,

who would be trained/responsible to complete the tracers, and which medications would be a priority area of focus. Initially, each pharmacy resident and clinical generalist pharmacist was required to complete four medication tracers per month (for a total of approximately 100 medication tracers completed department wide on a monthly basis). In order to reduce familiarity bias and promote an objective view of the system, pharmacists were encouraged to complete medication tracers on patients that were admitted to areas outside of their normal working environment.

Following the PDSA cycle model, it was essential to pilot the tool on a smaller scale for evaluation of its utility and applicability prior to implementing widespread use. After a 2-month trial, the tracer tool and process were reassessed. The majority of the feedback from the staff focused on the repetitive nature of the process (ie, in completing the pharmacy dispensing area tracer, pharmacists were repeatedly interviewing the same staff members on a weekly basis). Additionally, the entire tracer process, which is intended to be an in-depth assessment of the entire-use process, took each pharmacist almost 1 hour to complete. As staff buy-in was critical to the success of the process, changes were made in response to the feedback. The number of tracers required was reduced to one per month (for a total of 25 per month for the entire department). Furthermore, for the pharmacy-specific portion of the tracer, three different versions were developed, each with one-third of the original questions. This step was taken to reduce the repetitive nature of the tool. The patient-care area portion of the tracer was not modified, as there

are many more opportunities to speak to unique personnel in these areas.

Data Analysis

The tracer methodology is an excellent tool to identify the true state of the medication-use process. However, evaluating the entire medication-use system results in a great deal of data to be analyzed. In order to ensure that these data are monitored and that trends are identified and addressed, it is recommended that a designated individual enters and reviews these data on a monthly basis. After sufficient data have been collected (approximately 6 months' worth, or enough to identify a strong baseline), results can be displayed through the use of annotated run-charts (graphed by MM, patient care unit, and step in the medication-use process). In run-charts, statistical process control limits should be placed at two standard deviations from the mean to help distinguish normal process variation from true variant outliers that require action. The run-charts may be placed in the pharmacy and patient care areas as a means for staff to monitor progress with medication safety efforts. Additionally, when significant detours from the medication-use policies or processes are discovered, directed educational sessions can be developed and implemented at a system-wide level.

The medication tracer tool is designed to quantify deficiencies or areas of improvement in the medication-use system. When used as part of a CPI program, it serves to objectively assess quality improvement efforts in the identified risk points. Multidisciplinary teams should be involved in the development of the tracer tool and known institution-specific risk points should be included for evaluation. Monthly analysis of the completed tracers will help identify targets for system improvements and staff education.

REFERENCES

1. Joint Commission on Accreditation of Healthcare Organizations. Facts about Shared Visions-New Pathways. http://www.jointcommission.org/AccreditationPrograms/Hospitals/AccreditationProcess/scoring_qa.htm. Accessed August 24, 2007.
2. Rozich JD, Resar RK. Medication safety: one organization's approach to the challenge. *J Clin Outcomes Manage*. 2001;8(10):27-34.
3. Kohn LT, Corrigan JM, Donaldson MS, eds. *To Err is Human: Building a Safer Health System*. Washington, DC: National Academy Press; 2000.
4. The Leapfrog Group. Factsheet: Computer Physician Order Entry (CPOE) November 2000. http://www.leapfroggroup.org/media/file/Leapfrog-Computer_Physician_Order_Entry_Fact_Sheet.pdf. Accessed March 24, 2005.
5. Classen DC, Pestonik SL, Evans RS, Lloyd JF, Burke JP. Adverse drug events in hospitalized patients: excess length of

stay, extra costs, and attributable mortality. *JAMA*. 1997;277(4):301-306.

6. Bates DW, Leape LL, Cullen DJ, et al. Effect of computerized physician order entry and a team intervention of prevention of serious medication errors. *JAMA*. 1998;280(15):1311-1316.

7. Bates DW, Spell N, Cullen DJ, et al. The costs of adverse drug events in hospitalized patients. Adverse Drug Events Prevention Study Group. *JAMA*. 1997;277(4):307-311.

8. The James S. Brady Press Briefing Room. Press briefing by senior administrative officials on President's Initiative to Reduce Medical Errors. February 22, 2000. www.ahrq.gov/wh22200brf.htm. Accessed March 24, 2005.

9. Empire Blue Cross Blue Shield. Three Fortune 500 Companies Join Empire Blue Cross and Blue Shield to Recognize and Reward Hospitals that Achieve Leapfrog Safety Standards [press release]. New York, NY: Empire BCBS; October 19, 2001. http://www.empireblue.com/wps/portal/ehpfooter?content_path=shared/noapplication/f0/s0/t0/pw_ad069498.htm&label=October%2019,%202001. Accessed August 24, 2007.

10. Leape LL, Bates DJ, Cullen DJ, et al. Systems analysis of adverse drug events. ADE Prevention Study Group. *JAMA*. 1995;274(1):35-43.

11. Reason J. Human error: models and management. *BMJ*. 2000;320(7237):768-770.

12. Langley GJ, Nolan KM, Nolan TW, Norman CL, Provost LP. *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance*. San Francisco, CA: Jossey-Bass Publishers; 1996.

Appendix A. Partial example of tracer tool used at The Ohio State University Health System.

**The Ohio State University Medical Center
Medication Management Tracer Checklist
Pharmacy Checklist**
Date _____

Tracer Team Member _____
Staff Member Name _____
Time Medication Ordered _____

Patient MRN _____ Medication Traced _____

Note: This checklist should be returned to the Department of Pharmacy and selected medication order should be attached

Directions:

1. Select Medication Order for review
2. Record time stamp
3. Complete Central Pharmacy Checklist
4. Complete Nursing Unit Checklist
5. Compile responses on Master Checklist
6. Calculate compliance for each Standard and Aspect

Medication Management System				
Activity	Yes	No	Not Applicable	Notes
Patient-Specific Information				
MM1:10				
Are patient's age, sex, and current medications readily accessible and available to the pharmacist entering the order?				
Are the patient's diagnoses, comorbidities, and concurrently occurring conditions readily accessible and available to the pharmacist entering the order?				
If the patient is receiving any medications that require monitoring via laboratory values, are the laboratory values readily accessible and available to the pharmacist entering the order?				
Are the patient's correct allergies readily accessible and available to the pharmacist entering the order? Do the allergies listed on the medication order match the allergies listed in the pharmacy information system?				
If the patient is receiving any medications that require weight-based or renal function-based dosing, is the patient's height and weight readily accessible and available to the pharmacist entering the order?				
Is the patient's pregnancy and lactation status readily accessible and available to the pharmacist entering the order?				
Ordering and Transcribing				
MM3:20				
Can the order-entry pharmacist describe the proper procedure for taking verbal medication orders?				
Does the pharmacy system order match the CPCE or written medication order?				
In non-CPCE areas, can the nurse/ pharmacist describe what he/she would do in the event of an incomplete, illegible, or unclear order?				
Preparing and Dispensing				
MM4:10				
Can the order-entry pharmacist describe the process for reviewing a medication order for appropriateness and interactions?				
Can the order-entry pharmacist describe the "override" policy? When is it appropriate for nurses to "override" a medication in Pxyts?				
MM4:20				
Does the pharmacy technician preparing the IV medication have the appropriate and current competency exams on file?				
Can the pharmacy technician describe the process of sterile product preparation and the steps taken to ensure safety of the finished product?				
Has the pharmacy technician attached the appropriate auxiliary labels and expiration date to the finished product?				
Has the laminar flow hood used to prepare the IV medication been inspected in the last 6 months?				
MM4:40				
Was the quantity of medication dispensed appropriate for a maximum of 24 hours (or until next scheduled cart-fill)?				